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Impact of Various Clothing Variations on Firefighter Mobility: A Pilot Study

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Background and aim

During their tasks, firefighters can be exposed to extreme heat (e.g., 571.5°C at ceiling height). To protect officers from environmental conditions, personal protective equipment (PPE) is worn, which can weigh between 17 and 25 kg.

In addition to the load weights, the nature of the equipment and clothing worn is known to reduce mobility and has been considered to increase the risk of injury through increasing the potential for a slip, trip or fall.

These are common mechanisms for firefighter injuries to occur. Therefore, the aim of this study was to investigate differences between clothing variations and firefighter mobility.

Methods

- Data were collected from eight firefighters using a randomized counterbalanced, repeated measures, design.
- Three different clothing variants (V1–V3) in addition to current station wear (S) were trialed. Combinations of S and V1 (SV1) and V2 (SV2) were also trialed.
- Outcome measures included: standing reach height; the Functional Movement Screen [FMS]; vertical jump; a visual analogue scale [VAS] for the FMS, vertical jump, step-ups and crawl; and a mannequin sketch to mark areas of discomfort.

Different clothing variations can impact the injury risk in firefighters.

Clothing allowing better performance may reduce current injury levels.



Results

FMS Results:

- Pairwise comparison revealed a significant mean percent increase of 9.5% ($p = 0.007$) and 13.0% ($p = 0.013$) in total FMS score when wearing V2 and V3 compared to wearing V1.
- The deep squat was more significantly affected by V1 than V2 ($Z = 2.236$ $p = 0.025$) while rotary stability was more affected by V2 compared to S ($Z = 2.000$ $p = 0.046$).

Reach Height and Vertical Jump Results:

- Within subjects reach height of participants did not differ significantly between clothing variants, or with the addition of SV1 or SV2.
- Vertical Jump height did not differ between the four clothing variants or SV1 or SV2.

Perceptions of Effects of Each Clothing Variant on Task Performance:

- V1, V2, and SV1 were rated significantly worse than V3 (mean VAS difference: -7.8, $p = 0.001$, 95%CI [-11.79 to -3.81], -5.15, $p = 0.033$, 95%CI [-9.86 to -0.44], and -5.16, $p = 0.022$, 95%CI [-9.26 to -1.06], respectively)

Conclusion and implications

V3 was preferred over S in all tasks and performed better both objectively and subjectively. While V1 was typically associated with poorer performance, the impacts of V1 and V2 when compared to each other and S varied depending on the tasks performed.

Areas of discomfort across all variations were the knees, followed by the thighs.

This research supports the impacts of firefighter clothing on mobility and provides avenues for future research to focus on firefighter clothing as an approach to mitigate injuries through potentially improving movement capacity and comfort.